GUIDANCE FOR ASSESSING BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE (BATEA) AND DEVELOPING TECHNOLOGY-BASED STANDARDS

Government of Alberta
Environment

Guidance for Assessing Best Available Technology Economically Achievable (BATEA) and Developing Technology-Based Standards

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EXECUTIVE SUMMARY

The purpose of this guidance document is to discuss the general concept of Best Available Technology Economically Achievable (BATEA) and the development of technology based standards.

This document attempts to provide:

1. A common understanding and language within Alberta Environment (AENV) about BATEA and technology based standards, including terminology;

2. Common approaches to assessing BATEA and developing technology based standards, and how to apply such standards, as appropriate;

3. Clear approaches that can be shared with internal staff (policy writers and those involved in the setting of source standards) and external stakeholders; and

4. A reflection of Alberta Environment's current practices for technology assessments.

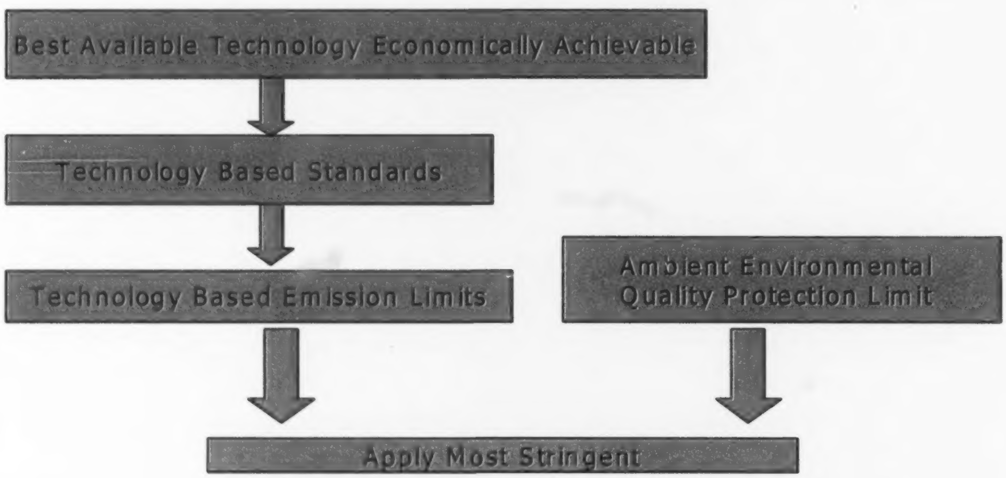
This document supports other documents currently in existence including the *Industrial Release Limits Policy*. AENV encourages collaborative processes with industry, non-government organizations (NGOs) and other levels of Government during the development of BATEA and technology-based standards. **Alberta Environment retains ultimate authority and has the right to determine BATEA in a manner that supersedes this guidance where warranted.**

1.0 BACKGROUND

Technology based standards have been an integral part of air, land and water environmental management systems in Alberta for many years.

At this time, Best Available Technology Economically Achievable (BATEA) determinations are used to inform emission standards and requirements set in regulations, approvals, codes of practices, standards documents, guideline documents, and directives. Technology based standards should then be used to both inform and develop emission limits set in approvals or codes of practice. These technology based limits are determined and then applied in conjunction with a parallel assessment of the receiving environment. AENV policy dictates that the more stringent result is applied. Figure 1 illustrates the relationship between BATEA, technology based standards and technology based limits.

Figure 1: BATEA and Technology Based Standards



In the past, there have been many terms which have been defined and used across jurisdictions, organizations and environmental media to inform technology based standards. These terms were developed to fit within the context of the jurisdiction's specific regulatory system. AENV has also historically used various terminologies to describe technology based standards.

However, there has been inconsistent understanding and application of such terms amongst all affected stakeholders within Alberta. A sampling of terms currently in use or that have been used include:

Air

- Best Available Control Technology (BACT) used by the United States Environmental Protection Agency (USEPA);
- Best Available Control Technology-Economically Achievable (BACTEA) used by the Government of Ontario, Ministry of Environment;
- Best Available Demonstrated Technology (BADT), Alberta Environment, Air Toxics Management Plan
- Best Available Retrofit Technology (BART) used by the USEPA;
- Lowest Achievable Emission Rate (LAER) used by the USEPA;
- Maximum Available Control Technology (MACT) used by the USEPA;
- Reasonably Available Control Technology (RACT) used by the USEPA;

Water

- Best Practicable Control Technology Currently Available (BPT) used by the USEPA;

Hazardous Waste

- Best Demonstrated Available Technology (BDAT) used by the USEPA;

Multi-media

- Best Available Techniques (BAT) used by the European Union ; and
- New Source Performance Standards (NSPS) used by the USEPA;

In 2003 the Clean Air Strategic Alliance's Electricity Project Team developed the new, Alberta specific terminology, Best Available Technology Economically Achievable (BATEA). BATEA was defined as "technology that can achieve superior emissions performance and that has been demonstrated to be economically feasible through successful commercial application across a range of regions and fuel types." This concept, although developed during standard setting for the electricity sector, is now beginning to be used in other applications. However, unlike the Clean Air Strategic Allliance's Electricity Project Team, the scope and objective of analysis and economic evaluation methodology for these other applications have not been well defined.

This guidance document is intended to provide a unified understanding and common terminology that are to be used by AENV when dealing with technology based standards, which from here on will be informed by the principles, technology assessment considerations and outcomes of BATEA.

Technology based standards are only one part of the AENV regulatory and cumulative effects management framework. As mentioned previously, this document is intended to specifically deal with technology based standards and to provide additional guidance to documents currently in existence including the *Industrial Release Limits Policy*. It is not intended to be applied in isolation of these other regulatory documents and initiatives. The focus of BATEA in a cumulative effects framework is to meet the following outcomes:

- Reductions in environmental footprints from industry;
- Ensuring continuous improvement; and
- Developing a benchmark and base level for industrial performance requirements.

Within the broader regulatory framework, technology based standards are about setting standards for both new and existing facilities. Such standards can be either based on pollution control technologies or pollution prevention approaches.

2.0 PRINCIPLES

The development of BATEA is based on the following principles:

a. Continuous improvement by:

- moving to the next level of environmental performance that either meets or exceeds current levels of performance;
- periodically review to ensure that requirements are current; and
- developing a plan for implementation of the standards over a specified timeframe at existing facilities.

Existing facilities have a commitment to ensure ongoing continuous improvement in environmental performance, consistent with a company's overall commitment to enhanced environmental performance.

b. Transparent and informed technological and economic analysis is conducted during the standard setting process. See Part B for guidance on types and purpose of economic analysis.

c. Sector based performance standard setting : Sectoral consultation and a consensus based approach is one of many approaches that could be considered to set source emission standards.

d. Guided by cumulative environmental effects considerations. Performance standards are set to achieve regional objectives and due consideration is given to potential future uses of environmental capacity.

The intent of BATEA is to drive innovation and improve environmental performance through setting performance standards.

3.0 TECHNOLOGY ASSESSMENT CONSIDERATIONS

Technology assessment is conducted with regards to technology identification, environmental performance and economic considerations. Part A outlines technology identification and environmental performance considerations during technology assessment.

Depending on the objective of the analysis, several economic assessment options (e.g. cost efficiency, cost effectiveness, demonstrated technology) are possible. Part B outlines several options available for conducting economic assessments. The selection of a particular option is not prescriptive but should align with the objective of the assessment. Once a particular option is chosen however, analytical process outlined under each option must be followed to ensure a robust and defensible analysis.

The technology assessment could be conducted as part of a variety of engagement processes, including both multi-stakeholder and national processes. Use of a third party to provide independent advice or assessment can be used as input to help formulate the decision. Note that the intent of the technology assessment is not to engage in a detailed financial analysis on a facility-by-facility basis. It is also not the intent of this process to ensure the ongoing viability and continued operation of all existing facilities when new requirements are put in place.

4.0 IMPLEMENTATION CONSIDERATIONS

Implementation may vary depending on whether the facility is:

- New (immediate implementation) as outlined in Figure 2; or

- Existing (phased in over an established time period) or at end of life (where implementation may not be necessary within a set time period after which the facility commits to shut down) as outlined in Figure 3.

Figure 2: Technology Based Emission Limit Setting Process For New Facilities

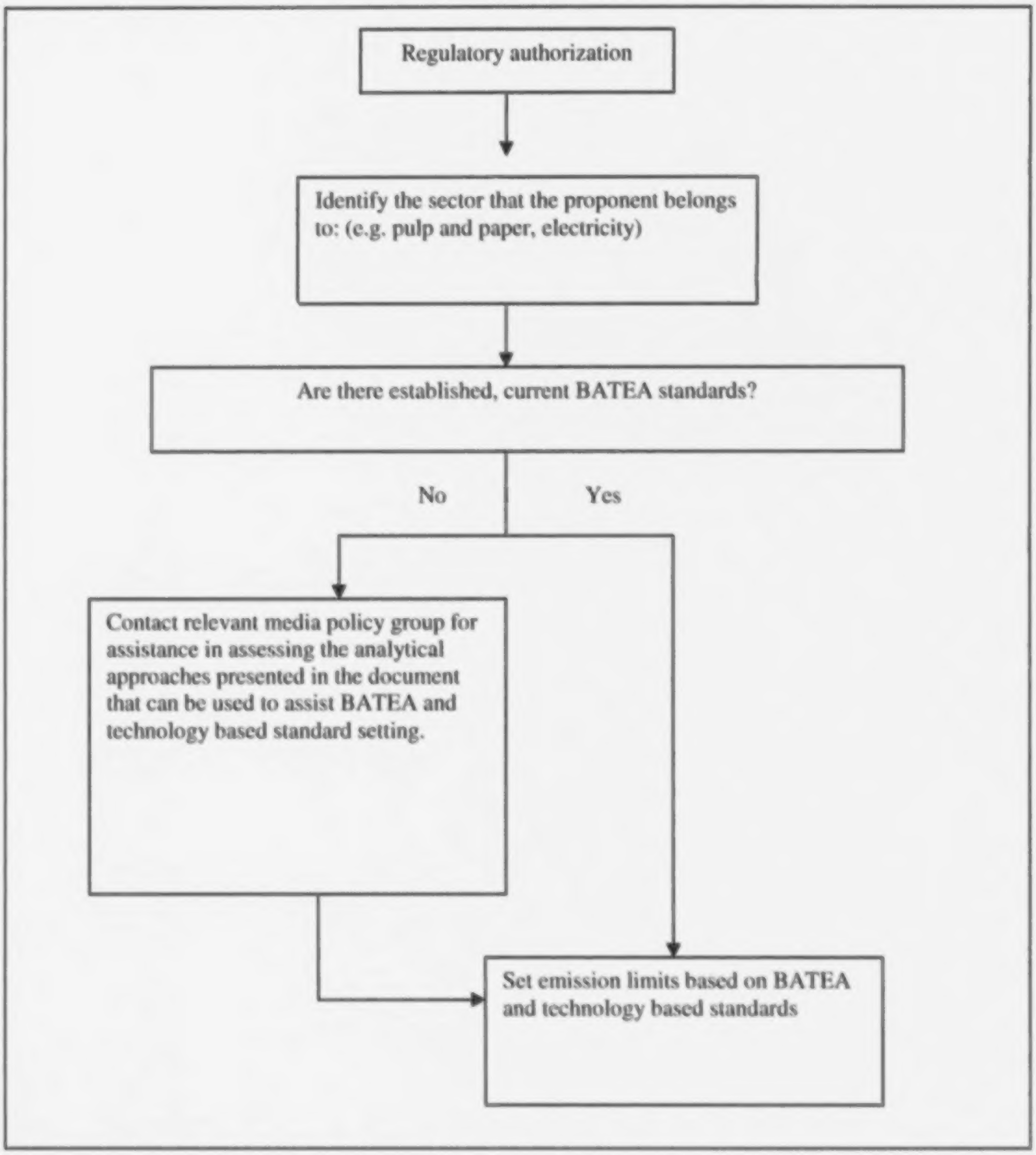
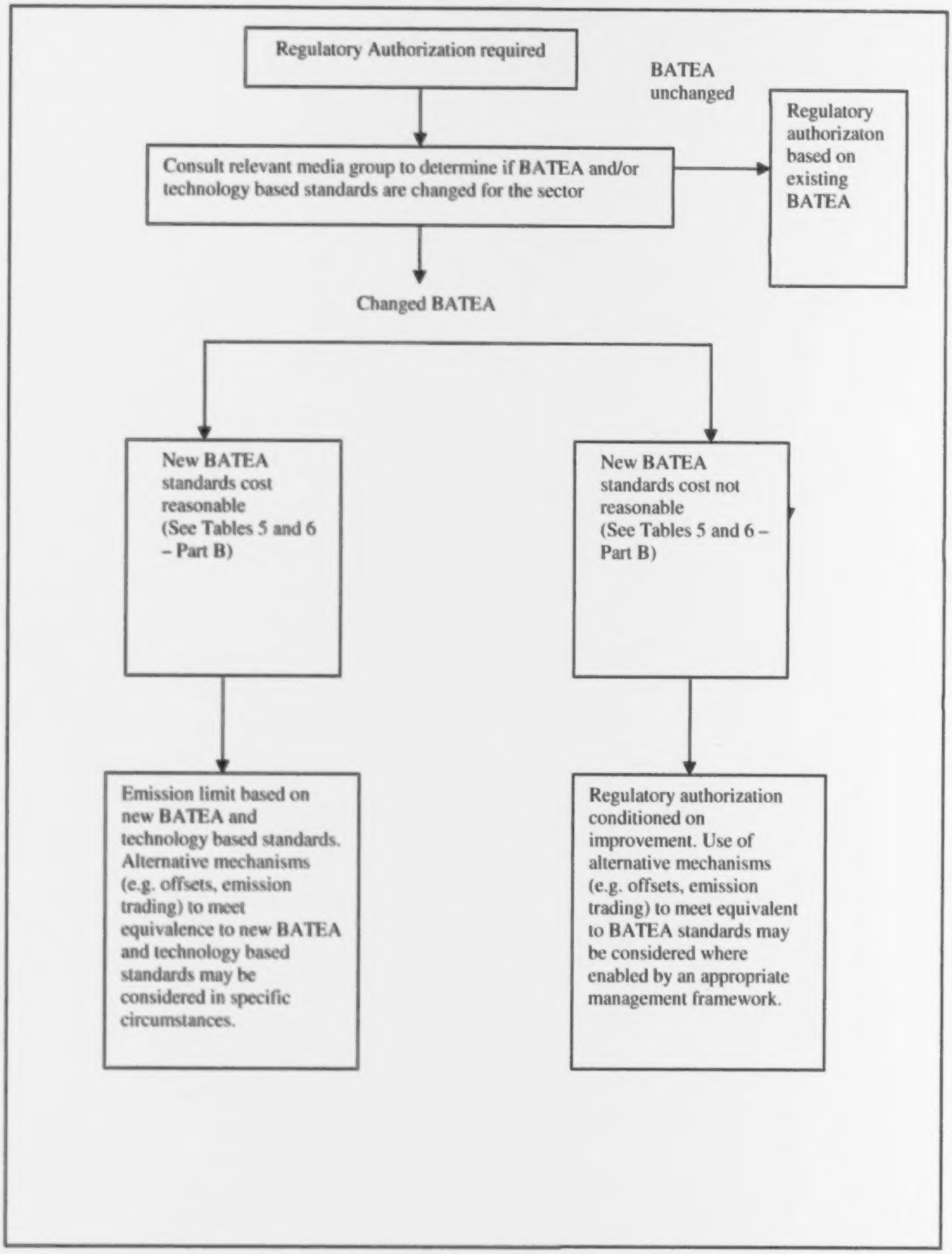


Figure 3: Technology Based Emission Limit for Established Facilities



5.0 PART A - ENVIRONMENTAL PERFORMANCE ASSESSMENT

a. Technology Identification Steps

i. Identify all technologies for the pollutant of interest

ii. Elimination of technologies not used with the sector of interest

iii. Eliminate technically infeasible control technology for the scale and pollutant of interest

iv. Generate a suite of potential pollution control technologies that could be suitable for the scale, sector and pollutant of concern.

  a. identification of sources and process of interest

  b. contact equipment vendors, manufacturers, and stakeholders.

  c. review of requirements in other jurisdictions

  d. contact industries currently using these technologies

v. Confirmation that the technologies have been commercially demonstrated on similar facilities (both for new and existing facilities)

vi. Screening of the technologies based on specific parameters such as emission intensity, removal efficiency or, energy efficiency

vii. Assessment of whether the technologies are considered to be transformative (step change improvements in performance) versus incremental technologies (technologies that improve performance marginally)

viii. Consideration of technologies for use at multiple facilities, complexes and clusters

b. Technology Assessments

- Environmental assessment of both the impacts and benefits of the above technologies (may not be needed if a specific removal efficiency is needed to address environmental stresses):
    - water needs
    - energy demands (e.g. energy penalty or parasitic load)
    - chemical use
    - waste issues
    - land disturbance
    - transportation issues
    - environmental tradeoffs, environmental benefits, collateral emissions

6.0 PART B – OPTIONS FOR ECONOMIC ASSESSMENT

General guidance:
Economic analysis depends on a range of input parameters that guide decisions. Regardless of the analytical approach chosen, an analysis should be conducted according to good practice such that each analysis:

i. is transparent to an informed reader;

ii. presents all relevant information;

iii. contains complete information on the method used, so that (if necessary) the analysis can be replicated;

iv. is accurate and without material error (i.e., errors – if subsequently found – do not have the potential to change a decision); and

v. is consistent in the method used to compare alternatives.

Roles and Responsibilities:

Each of the methods outlined below require varying degrees of participation by the government, outside stakeholders, and the general public. Government's role is mainly objective setting and to define parameters under which an assessment is to be conducted. Outside stakeholders and the general public's role is to provide input and comments in objective setting. The government has the discretion to conduct the required analysis in-house, hire external third party, or request information from outside stakeholders and the public to help inform decision making. These inputs and comments can guide the government in standard setting.

1. Benefit –Cost Analysis

Benefit-cost analysis provides a framework to aid in economically-efficient decision making. This approach is distinctly utilitarian in its philosophy in that it weighs the expected benefits of an action relative to expected costs to guide decision making. As an analytical tool, a benefit cost analysis is compatible with a cumulative effects management system since such a system provides the strategic direction for the issue to be examined, while benefit cost analysis provides the analytical approach to address the issues identified. The decision process and objective of benefit cost analysis consists of:

1. Identifying the appropriate environmental objective by comparing the potential benefits and cost of a policy.

2. Identifying management options and tools to meet the objective.

3. Comparing relative merits of options and tools for implementation.

4. Post implementation evaluation.

Benefit-cost analysis can be used during different parts of the decision making process. Depending on the complexity and the scale of the issue being addressed, benefit-cost analysis may inform all or some of the decision process.

i. Decision Guidance Criteria

Benefit cost ratio shows the magnitude of benefits to costs (e.g. ratio of 2.0 shows that benefits are twice as large as costs). Decision rules of benefit cost analysis address "net benefit" and "efficiency" concepts through benefit cost ratio. Decision criteria are such that:

- Undertake an action which has a benefit cost ratio greater than one (net benefit).
- Select an action that has the highest benefit cost ratio among the actions considered (most efficient).

Note that benefit cost analysis requires monetization of all the relevant benefits and costs; this monetization is not always possible. In such cases, it is good practice to provide qualitative description of unmonetized benefits and costs such that a better informed decision can be made (see example in Table 2).

Within the context of BATEA and technology based standard setting, benefit cost analysis shows not only the efficiency and net benefit concepts but also highlights the distributional effects (e.g. how the benefits and cost are distributed, who bears the benefits and costs). Understanding these effects can be an important consideration in a regulatory process.
It is best practice to first examine whether an action produces a net benefit overall to society by taking into account accurate and relevant costs and benefits before examining distributional issues. Although distributional issues are secondary in the order of analysis, these issues are not necessarily secondary in importance.

ii. Applicability to Standard Setting

Given the scope of analysis involved, governments or regulatory agencies typically perform or require benefit-cost analyses when considering significant policies. Results of these analyses have been used to inform regulatory decisions (see example in Table 1 - benefit cost analysis of sulphur in gasoline standards enacted by the Government of Canada).

Strength:

Allows consideration of a range of alternatives and the relative costs and benefits of those alternatives to inform decision making

Limitation:

Potentially high data requirements, including need for primary research to determine the cost and benefits of the proposed standards.

iii. Benefit Cost Analysis: An Example

As part of the regulatory impact assessment statement, the Government of Canada conducted the benefit-cost analysis of the sulphur control standards in gasoline to ensure that the benefits of the standards were greater than the cost (standard is efficient). Table 1outlines the benefit-cost analysis steps and the associated data requirement. Table 2 provides an example of the benefit cost analysis.

Table 1: Benefit Cost Analysis Steps and Data Requirements

Benefit-Cost Steps	Data Requirements
1. Identify Issues, Risks, and the Baseline Scenario i. High sulphur levels in gasoline increase emissions of sulphur dioxide and sulphate particles from vehicles. ii. Emissions of pollutants from vehicles harm the environment and people's health.	Regulatory agency: Data and/or documentation that outline the issues, risk and baseline scenario (what issues can arise with or without regulatory intervention).
2. Set outcomes to address the issue i. Reduction in sulphur content in gasoline by 2005	Regulatory agency: Data and/or documentation to justify objective setting
3. Explore management options and delivery tools to address the issue Management options i. Complete ban on sulphur (Option 1) - technically possible but currently cost relative to benefits below 30 ppm reduction very high. ii. Reduction to 30 ppm by 2002 (Option 2)- provides the earliest and largest benefit, but costs for industry adjustment are high. iii. Reduction to 30 ppm by 2002 for populated areas/selected regions (Option 3) - results in unequal health benefits across regions. iv. Phased reduction over 2002 to 2005 (Option 4) - likely preserves most of the benefit as Option 2, but comes with reduced cost by allowing for industry adjustment. Voluntary measures: not suitable due to the seriousness of the issue. Economic instrument (emission charge): unable to meet environmental objective by 2005. Economic instrument (cap and trade): unworkable, leading to inefficient outcome due to market dominance by a few players in some regional markets. Command and control (each refinery meets prescribed standard): most effective at meeting the objective.	Regulatory agency: Data and/or documentation to justify selection of management option and tool Industry: submission of industry specific data

Benefit-Cost Steps	Data Requirements
4. Benefit cost assessment	See Section 7 - Glossary (Guidance on Benefits and Cost Values) for details on cost and benefit categories generally used in a benefit cost analysis. See Table 2 for a specific example related to sulphur in gasoline regulations.
5. Recommendation	No data requirement, regulatory agency recommends a course of action based on results of benefit cost assessment.
6. Performance Evaluation	Regulatory agency: Undertake compliance inspections and/or review industry submissions regarding sulphur content in gasoline being produced.

Table 2 Example of Benefit Cost Analysis

Input Data:

Capital cost: $1788 million (all expense incurred in year 1) Operating cost: $ 119 million annually
Benefit: $4.1 billion present value benefit of avoided adverse health effects from reduced mortality and morbidity (undiscounted benefits not provided in regulatory statement to derive yearly data)
Time horizon: 20 years
Discount rate: 10%
Sensitivity: 3% to assess the sensitivity of discount rate to present value calculation

Year	Present Value Cost (Millions)	Present Value Benefit (Millions)
1	$\frac{\text{Capital+ operating cost}}{(1\text{+discount rate})^{\wedge 1}}$ $=\frac{1788+119}{1.1}$ =1,744 million	
2	$\frac{\text{operating cost}}{(1\text{+discount rate})^{\wedge}2}$ $=\frac{119}{1.21}$ =98.35 million	
3	89.41	
4	81.28	
5	73.89	
6	67.17	
7	61.07	
8	55.51	
9	50.47	
10	45.88	
11	41.71	
12	37.92	
13	34.47	
14	31.34	
15	28.49	
16	25.90	
17	23.54	
18	21.40	
19	19.46	
20	17.69	
Sum of present value	$ 2,649 million	$4,100 million
Net present value (benefit-cost) at 10% discount rate	$4,100 – $2,649 = $1,451	
Sensitivity (3%) rate – present value	$3,518	$8,000
Net present value (benefit-cost) at 3% discount rate	$8,000 – $3,518= $4,482	
Unmonetized values	• likely minimal compliance/ administration/ monitoring costs to government	

	• end user – likely minimal increase in cost of fuel • competitiveness - able to market higher quality gasoline • vehicle/fuel compatibility- lower sulphur gasoline allows use of more efficient engines and meet other air quality and GHG objectives • regulatory flexibility – phased approach (2002 to 2005) allows suppliers to find cost-effective way to meet the standards (not monetized) • improved environment from reduction in sulphur emissions Distributional effects: (economic impact) – some refineries may shut down but losses in employment and income from these shutdown are likely to be offset by other sectors in the economy, the net employment and income effects are expected to be minimal.
Summary and recommendation: Benefit cost ratio ranges from 1.6 (4.1/2.6) to 2.3 (8.0/3.5), indicating that the benefits of the regulations are greater than the costs to society. The ratio does not include non monetized benefits to the environment and industry competitiveness. There are some regional distribution effects from potential shut down of refineries that may not be able to upgrade to new standards. Employment and related financial losses from these shutdowns are likely offset by economic activity in other sectors. Based on the results of the benefit cost analysis, enacting the proposed regulation is recommended.	

2. Cost Effectiveness Analysis

Cost effectiveness analysis is often used in cases where the benefits of pollution reduction cannot be readily expressed in monetary equivalents. This analysis determines the cost to achieve the desired environmental objective by dividing the present value of total costs by the quantity of pollution reduction. Cost ratio indicates the costs per unit of pollution reduction (e.g $/tonne). Cost effectiveness requires regulators to define a technology performance objective as well as the parameters for cost reasonableness, specifically, setting acceptable incremental cost increase associated with new standards.

i. Decision guidance criteria

Among the control options that meet the objective, choose the option that has the lowest cost ratio.

ii. Applicability to standard setting

Given the scope of analysis involved, governments or regulatory agencies typically perform or require cost effectiveness analysis to inform regulatory standards.

Strength:

Reduced data requirements when compared to benefit-cost analysis. Monetized benefit information is not required and cost information can be available through equipment manufacturer, cost databases or through vendor or regulatory agency reports (e.g. US EPA).

Limitation:

Does not allow for consideration of a range of alternative options (e.g. alternatives to technology based standards to meet equivalent performance objective) to meet an objective.

iii. Cost Effectiveness Analysis: An example

Table 3 outlines the cost effectiveness analysis steps and associated data requirements.

Table 3: Cost Effectiveness Steps and Data Requirements

Cost-effectiveness steps	Data requirements
1. Define standard	Data and/or documentation that outline the rationale for selecting the objective.
2. Identify applicable control technology	Data and/or documentation that supports the identification of control technologies (e.g. literature review of application and processes elsewhere).
3. Screen out technologies that do not meet criteria	Data and/or documentation for the evaluation and screening.
4. Identify acceptable control technologies and associated environmental performance	Regulatory agency - data and/or documentation used to support technology identification.
5. Determine control cost	Technology costs from cost databases, equipment manufacturer
6. Determine cost ratio (see Table 4)	Regulatory agency and stakeholders/affected parties: Cost information should be derived using published costing manuals/database and/or where applicable, most accurate information. If changes to default values found in the manuals/databases are required, sufficient explanation should be provided for those changes.
7. Assess cost reasonableness	See Tables 5 and 6 on data requirements for assessing cost reasonableness.

Cost Ratio:
Cost ratio calculation is a two step process (Table 4).

1. Determine the total annual cost (TAC)

$$TAC = (OC - SAV) + [(K * (i/(1-(i+1)^{-n})] - [REV]$$

where TAC is total annual cost; OC is operating cost; SAV is savings from changed operations; K is capital cost; i is discount rate; n is number of years.

For simplicity, assume that savings (SAV) from changed operations and revenues from byproduct sale (REV) are zero.

2. Divide the TAC with emission removed

Table 4: Cost ratio Calculations

Data Input	Technology X (Existing)	Technology Y (Proposed)
Operating cost (OC)	75	80
Capital Cost (K)	1000	1100
Interest rate (i)	0.08	0.08
Time horizon in years (n)	20	20
Annual emission removal (tonnes)	160	175
Total Annual cost	$177	$192
Cost ratio ($/tonne)	1.1	1.1

Cost Reasonableness:

Two cases are applicable for cost reasonableness: new approvals and renewals. Depending on the case being assessed cost reasonableness criteria includes examining the cost removal ratio and change in emission relative to change in cost. Table 5 shows cost reasonableness assessment for new approvals. Table 6 shows cost reasonableness assessment for a renewal which recognizes that there is a balance between seeking continuous improvement (incremental change) and acknowledging capital turn over (complete retrofit). Under specific circumstances, new BATEA and technology based standards may be met using alternative compliance mechanisms (e.g. offsets and emission trading) where it is deemed appropriate as part of a management framework.

Table 5 Cost Reasonableness Evaluation for New Authorization

Data Input	Technology X (Existing)	Technology Y (Proposed)
Compare removal ratio	1.1	1.1
Change in emission	N/A	((175/160)-1)*100 = 9.4% decrease
Change in cost	N/A	((192/177)-1)*100 = 8.5% increase
Cost reasonableness assessment	N/A	Standard based on Technology Y is cost reasonable since the cost ratio for Y is not greater than X and Y's emission reduction is greater than the cost increase.

Table 6: Cost Reasonableness Evaluation for Renewal of Existing Authorization

Data Input	Incremental change	Complete retrofit
Cost[2]	$192 - $177 = $15	$192
Emission removed	175 – 160 = 15 tonnes	15 tonnes
Cost ratio ($/tonne)	$15/15 tonnes = $1/tonne	$192/15= $12.8/tonne
Cost reasonable assessment	Renewal based on Y is cost reasonable since the new cost ratio is similar to existing cost ratio	Renewal based on Y is not cost reasonable since new cost ratio is higher than existing ratio of 1.1

[2] Note that tables provide an example only to illustrate the concepts of assessing cost reasonableness. In reality, retrofit cost could be much higher than costs associated with a 'greenfield' site.

Alternative approach to gathering pollution control cost

An alternative to gathering cost information, which can sometimes be difficult, are market prices of emission permits (provided that markets are well designed and functioning). These permits can also reveal information about the cost of pollution control. Although there are limited applications of emission credit systems currently in Alberta, it is important to note the value of such systems to reveal cost and abatement behaviour information when assessing information during standard setting.

3. Demonstrated Technology

Demonstrated technology examines the commercially demonstrated and operated technologies used locally or elsewhere.

Assessment of demonstrated technology approach implicitly considers costs. The assumption is that if there is commercial application of abatement technology elsewhere (may include other jurisdictions), then cost reasonableness of that technology is satisfied. The rationale for this assumption is that private industries minimize cost so their choice of abatement technology would implicitly reflect reasonableness of technology cost.

i. Decision Guidance Criteria

If there is commercial application of abatement technology, then cost reasonableness of that technology is satisfied.

ii. Applicability to Standard Setting

Governments or regulatory agencies typically perform or require a demonstrated technology analysis to inform regulatory standards.

Strengths:

Reduced data requirements when compared to other approaches.

Limitations:

Dependent on industry leaders to improve standards and it may not adequately address Alberta specific sector/industry.

7.0 GLOSSARY

Annualized (levelized) value – converts a present value (e.g. related to a capital cost) into a constant value that occurs in each year over a given time duration (amortization). Both levelized and non-levelized approaches yield the same present value.

Benefit cost ratio (benefits/costs): Discounted benefits divided by discounted cost.

Discount rate: Discount rate reflects the time value of money and is used to "normalize" values that occur in different years to a common base year (present value). There is an inverse relationship between the present value and the discount rate: a higher discount rate produces a lower present value. Economic evaluation should use a real discount rate (net of inflation) of 8% with sensitivity analysis conducted using 3% and 13% rates.

Net present value (NPV): sum of discounted benefits minus costs (net benefit) over a given time horizon. Net present value is given by:

$$NPV = \sum_{j=1}^{n} \frac{benefit_j - \cos t_j}{(1+i)^j}$$

Where NPV is the present value of a stream of future net benefit (benefit – cost) that occurs in period j; j is the time period (years); i is the real discount rate. An overall positive or negative net present value does not imply that net benefit will always be positive or negative over the entire time period of analysis. Decision criteria is typically defined in terms of undertaking an action whose net present value is greater than zero, however, alternate user defined decision criteria can also be specified Net present value is sensitive to the input parameters – discount rate, time horizon, and value.

Present value: related to net present value; however future stream of benefits or costs are calculated separately (net present value approach and separate calculation approach yields the same result if the input parameters are consistent between the two calculations).

Time period: maximum value of 20 years as this represents the number of years over which equipment can be depreciated under the current tax regulations.

Guidance on Benefit and Cost Values

Costs are generally easier to monetize that the benefits. However, for both cases where monetization is not possible, qualitative description of the costs and benefits should be presented alongside the numeric results of a benefit cost analysis.

Cost:

There are two main types of costs, capital and operating costs. Capital costs are one time expenses that provide a service over an extended period of time. Capital costs are comprised of:

- equipment purchase;
- installation costs; and
- design and project management costs.

Operation costs are recurring expenses incurred to operate capital equipment. Operation costs are comprised of:

- Ongoing material costs - raw materials, utilities, waste treatment/disposal, labour and maintenance;
- Insurance, administrative and other ongoing costs related to the operation and maintenance of the equipment; and.
- Compliance costs (could be borne by regulators, industry, or other third party).

Benefits:

Unlike costs, which typically have both one-off and recurring expenses, benefits are usually recurring and may include the following:

- Reduced risk of mortality and morbidity;
- Improved visibility (e.g. less smog);
- Odour reduction;
- Avoided damage to sensitive receptors;
- Reduced damage to infrastructure from reduced pollution;
- Material recovery; and
- Cost savings from improved efficiency.

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